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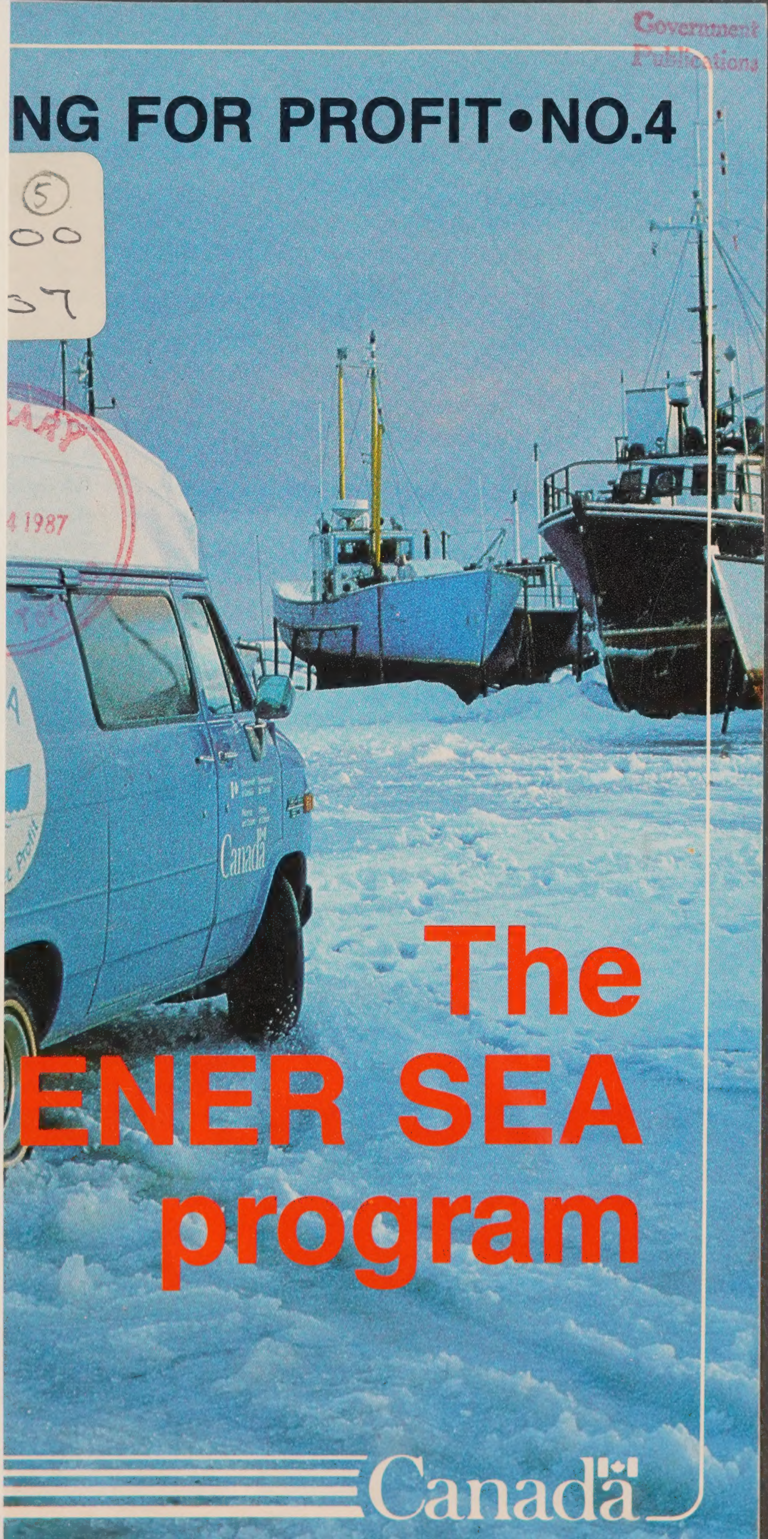
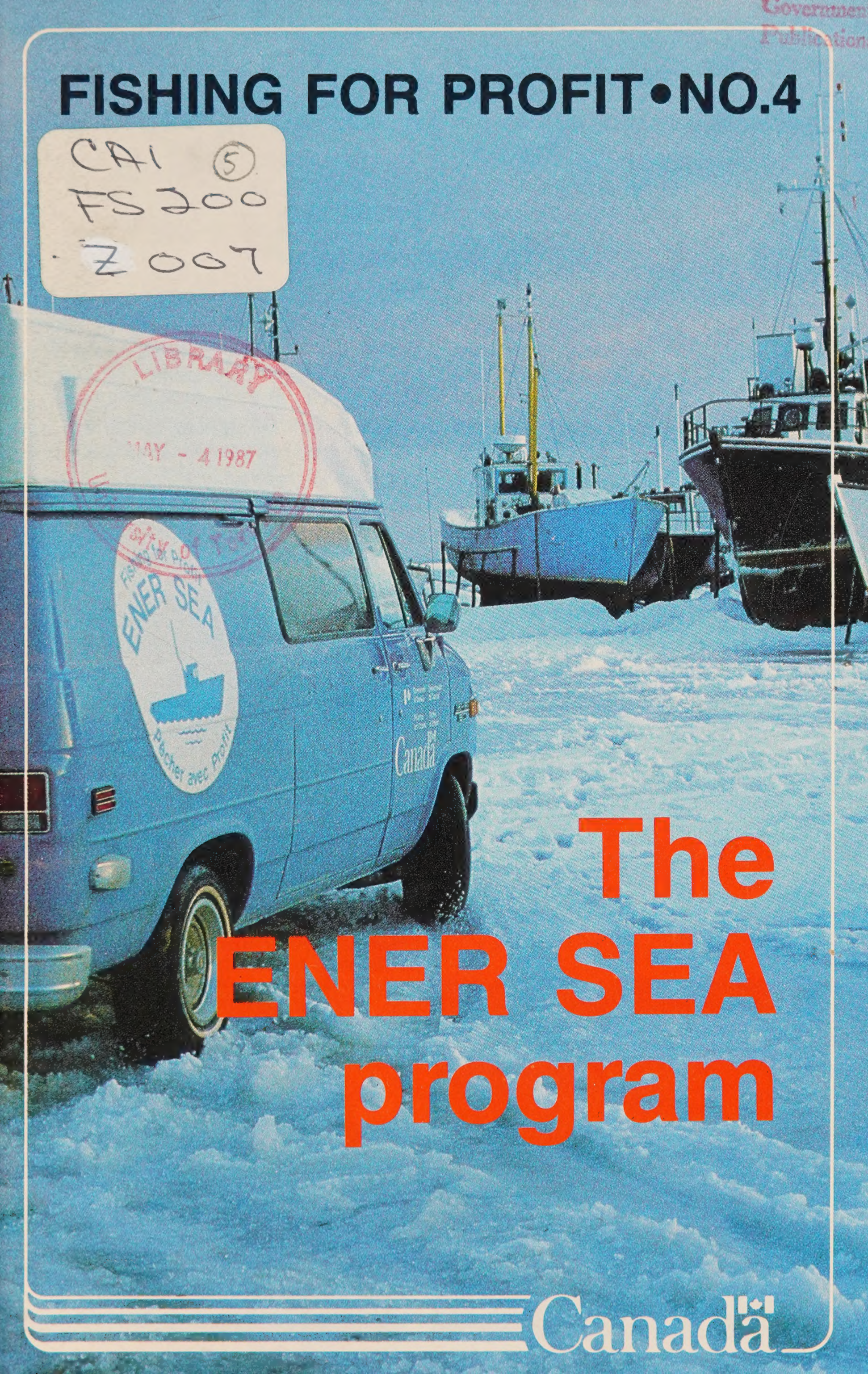


The ENER SEA program

Canada

FISHING FOR PROFIT • NO.4



The ENER SEA program

Canada

This brochure has been produced to inform fishermen of ENER SEA, a program developed by DFO in the Newfoundland Region to help fishermen control and reduce vessel operation fuel costs.

The ENER SEA Program offers fishermen a means of determining in advance the cost, and the value in fuel savings, of maintaining a clean boat bottom, installing a more efficient propeller or keeping a lighter hand on the throttle.

Although this brochure is produced for the benefit of fishermen in Newfoundland and Labrador, advice contained herein is applicable to fishermen in other parts of Canada.

For more information on the ENER SEA Program, fill out the questionnaire at the center of the brochure and forward it to the address below. If you have other cost cutting suggestions you would like to pass on, please contact the Technology Development and Transfer Division at this same address.

Fisheries and Habitat Management
Technology Development &
Transfer Division
Dept. of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland
A1C 5X1

(709) 772-4438

Are you fuel efficient?

Do you have the right propeller on your boat? How much is that garden growing on her bottom costing you in fuel? What is it worth to you in dollars and cents to have a lighter hand on the throttle?

With the aid of modern computer technology, the Technology Development and Transfer Division of DFO's Fisheries and Habitat Management, Newfoundland Region, has developed a program they can use to analyze your particular vessel and answer those questions for you. If you would like to have an energy efficiency analysis carried out on your boat, or if you have any questions or suggestions related to this topic, please contact:

Fisheries and Habitat Management
Technology Development and Transfer Division
Department of Fisheries and Oceans
Newfoundland Region
P.O. Box 5667
St. John's, Nfld. A1C 5X1
709/772-4438

Introduction

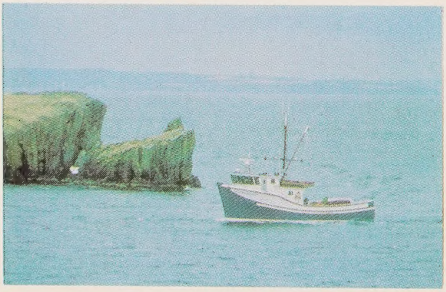
A penny saved is a penny earned.

Any time a fisherman can cut back on the cost of his operation, it's money in the bank.

For most fishing enterprises, costs can be broken into several categories: the cost of a boat; fishing gear and equipment; supplies; wages and associated costs; vessel and gear maintenance; insurance; and fuel. Not much can be done about some of these costs, wages and insurance for example. Shrewd purchasing, careful use and good maintenance practices can keep some other expenses at a manageable level.

However, one of the fisherman's major costs has also proved to be one of the most difficult to keep under control. Fuel — the energy needed to keep the boat moving — can be a real crippler.

Helping fishermen get a grip on energy costs is the aim of the **Energy Efficiency Program** of the Technology Development and Transfer Division. Under this program various projects have been carried out to determine ways in which fishermen can improve fuel efficiency in their operations. As a result of these projects and other program activities, advice on a wide range of matters, such as proper engine maintenance and the importance of using the right propeller on a boat, has been published in a series of pamphlets called "Fishing for Profit". These pamphlets are available from the division. The first three titles in the series are "Cutting the Cost", "Picking a Prop" and "Engine Efficiency".



However, division personnel were not satisfied simply with providing advice to fishermen as a group. They felt that to have a really significant impact it was necessary to get down to the level of the individual boat owner/operator.

The question was how to provide energy efficiency advice and assistance directly to individual owners on their vessels. The answer was — computers. And so through nearly two years of research and testing, the ENER SEA program was developed.

ENER SEA

The heart of the ENER SEA program lives in a blue and white Chevy van. It is a computer program designed to accept various items of information about a fishing vessel, do some complex calculations, and come up with energy efficiency analyses of three aspects of the vessel's operation.

These are the **propeller analysis,** the **operating analysis** and the **bottom cleaning analysis.** They are essentially sets of figures arranged in tables and graphs. The key information in each analysis is the figures which show current fuel costs and the new, reduced cost of operating with a different propeller, a properly cleaned and maintained vessel bottom or lower engine RPM's.

One great advantage of this mobile system is that it can be taken right to the fishermen in their communities. This means that the vessel analysis activities can be combined with meetings of fishermen and ENER SEA personnel at which questions on energy efficiency and other related matters, including the ENER SEA program itself, can be thoroughly discussed.

However, fishermen in isolated communities with no road connections can also use the vessel analysis system. All they have to do is supply the necessary information on their vessels to put into the computer.

To assist fishermen in isolated communities, or those in other places who prefer not to wait until the ENER SEA van can visit their communities, there is at the center of this brochure a questionnaire which can be completed, removed and mailed to the Technology Development and Transfer Division. This is the information which will go into the computer to provide the analysis of the vessel concerned.

The result will be returned to fishermen by mail. ENER SEA may be contacted by mail or telephone to answer questions or offer further advice relating to the energy efficiency profiles.

The Ener Sea profiles

The basis of the ENER SEA program is three 'profiles', or segments of a specially developed computer program. Each profile is used to demonstrate the efficiency of the present setup on a particular vessel, and to predict how changes in various aspects of vessel equipment or operating procedures might affect fuel economy.

Bottom cleaning profile

When a boat has been in the water for some time, various forms of marine growth attach themselves to the bottom. The buildup can vary from a thin layer of fuzz to barnacles, mussels, streamers of kelp and other unwanted materials in cases of extreme neglect. As the vessel moves through the water, any fouling disrupts the smooth flow of water over the hull, and creates eddies and swirls along the hull that rob you of speed and consume extra fuel. The application of good quality antifouling paint, which contains chemicals toxic to the marine organisms that create the bottom bouling problem can greatly reduce the rate of growth of the organisms responsible.

The **bottom cleaning profile** details the savings good bottom maintenance can achieve in fuel costs. (Table 1, Fig. 1) The fisherman supplies the computer operator with information on the type of paint preferred, the cost of haulout and application, and the amount of paint needed each season. He also includes information on the cost of fuel burned during the past season.

When the information is typed into the computer, the specially written computer program quickly performs calculations that show the fisherman how much fuel a clean bottom can save each year. The results also detail how long it will take to save enough fuel to pay for the cost of the bottom cleaning.

The saving shown by the computer is for fuel only, and doesn't include what is perhaps the most important saving good bottom maintenance promotes — the extension of a vessel's useful life. Attacks by marine worms and fungi can severely damage a boat's hull, leading to major repair bills or even a loss of years off the vessel's normal lifespan. The regular use of good quality antifouling paints can result in the addition of several years useful service. Two or three years added to a vessel's life can be a major financial boost to any fishing enterprise.

Table 1 gives the figures from the bottom cleaning analysis of one particular vessel. The fisherman who owns this boat can save $232 in fuel costs over one year's operations if he gives his boat a good bottom clean. The cleaning job will cost him $124. The net savings in one year are not great, but the care his vessel gets could add several years to her useful life. (Fig. 1 shows the same information in graphic form.)

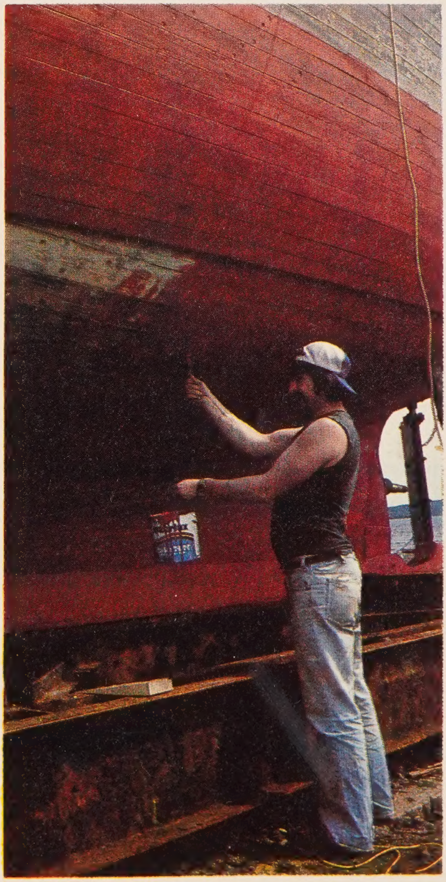
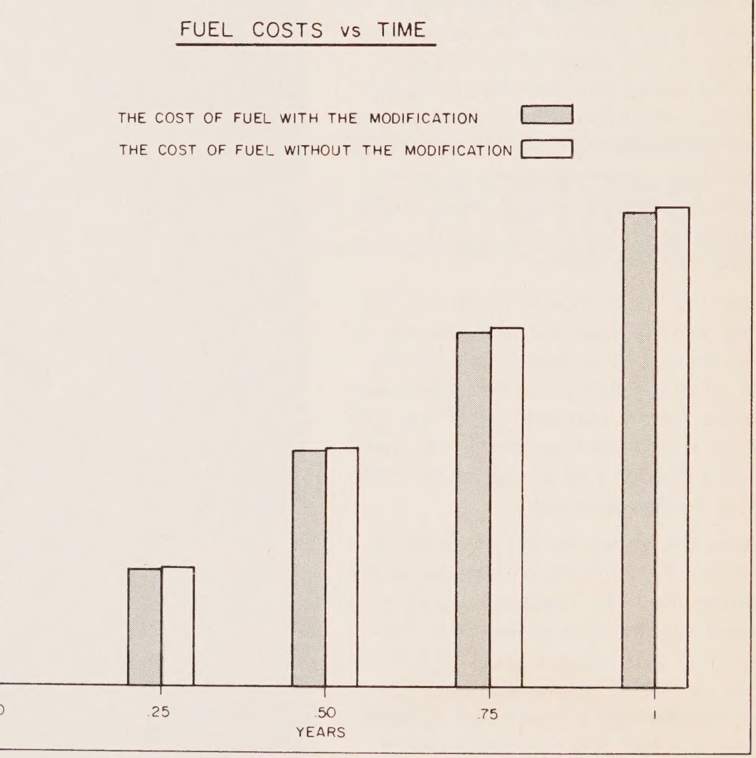


Table 1: Vessel Efficiency Analysis - Cost and Benefits

Improvements:	Bottom Clean
Efficiency Improvement %	0
Percent Fuel Saved	1.161004
Material Costs $	75
Installation Costs $	49
Total Costs $	124
Estimated Life (yrs)	1
Fuel $ Burned Last Year	20000
Fuel $ Costs with Modif.	19767.8
Fuel $ Saved Per Year	232.2007
Total $ Saved Over Life	232.2007
Payback Period (yrs)	.5340208
Rate of Return % (IRR)	83.99994

Fig. 1.



Propeller analysis profile

The second and most important component of the ENER SEA program is the **propeller analysis profile.** It's the propeller that drives the boat through the water. An excellent match of hull shape, engine size and propeller is needed to ensure that maximum fuel efficiency is achieved.

Drawing on information the fisherman provides, the computer operator tells the computer the particulars of the present prop. The information (called 'input' in computer jargon) details the maximum horsepower of the engine, its operating RPM's, and the gear reduction ratio. Also included are the diameter and pitch of the present prop (which is usually found stamped on the hub), the number of blades on the prop, and the vessel's operating speeds at several RPM levels.

Obtaining an accurate operating speed in knots can be tricky, as it's difficult to estimate speed through the water with precision. The ENER SEA van has been equipped with a radar gun to improve the accuracy of this input. It's vital that fishermen not overstate the real speed of their boats, despite an understandable desire to be considered the owner of a fast boat. Give the computer wrong information and it will give you back the wrong answers.

The rest of the information required deals with measurements of the clearances above and below the tips of the propeller blades, the depth of the boat's skeg, and the draft of the vessel aft. Table 2 shows the information put into the computer.

Table 2. Input Parameters

Maximum Shaft Horsepower	=	90		
Operating RPM	=	2400		
Gear Ratio	=	2.56		
Present Diameter	=	24		
Present Pitch	=	20		
Number of Blades	=	3		
Blade Area Ratio (BAR)	=	.52		
Operating Speed (knots)	=	7.8		
Clearance Above Propeller (ins)	=	6		
Clearance Below Propeller (ins)	=	6		
Depth of Skeg (ins)	=	12		
Draft (ft)	=	4.5		
Number of Blades (min, max)	=	3	4	
Blade Area Ratio (min, max, inc.)	=	.5	.7	.1

When the computer finishes comparing the propeller in question with the data it has stored, the results (outputs or answers) are projected on the screen in front of the fisherman. Table 3 shows current propeller conditions and tells the vessel owner the amount of thrust (forward push of the prop) and torque (the turning force of the motor, as measured on the propeller shaft) available from his engine. It also shows how much of the rated horsepower is being delivered as actual thrust, and then converts that figure to a per cent rating of efficiency.

Finally, the table shows the cavitation coefficient and cavitation number of the blade being studied. Cavitation is probably the most common cause of propeller damage. Often mistaken for electrolysis damage, cavitation results in the gradual destruction of the side of the blade facing the stern post. The cavitation coefficient and the cavitation number are used to determine the likelihood of cavitation occurring. If the results of the analysis show that cavitation is likely to be a problem, the computer operator can recommend changes in the blade area, diameter, pitch or operating RPM that can help alleviate or solve the problem.

Table 3. Current Propeller Conditions

Diameter	= 24
Pitch	= 20
No. of Blades	= 3
Blade Area Ratio	= .52
RPM	= 2400
Thrust (lb)	= 1819
Torque (ft-lb)	= 481
Power (hp)	= 86
Cav. Coef	= .239
Cav. Number	= .456
% Cavitation	= 10.61 %
Efficiency	= 40.51 %

ENERSEA
Analysis Questionnaire

Fishermen living in areas not served by roads can have an ENER SEA analysis performed on their vessel by completing this questionnaire. Fishermen living in areas served by road connections may not wish to wait for the ENER SEA van to visit their area; they may also avail of this mail-in service.

- ☐ Complete all sections of the form applicable to your vessel.
- ☐ Accuracy in taking the required measurements is essential to an accurate ENER SEA analysis. Study the diagrams carefully before taking your vessel's measurements.
- ☐ If you use approximate information for some sections (fuel costs, etc.) please indicate this.
- ☐ If you have any questions, contact the ENER SEA project personnel at 772-4027.

Mail to: ENER SEA Analysis
Technology Development & Transfer Division
Fisheries & Habitat Management
Dept. of Fisheries and Oceans
Newfoundland Region
P.O. Box 5667
St. John's, Nfld.
A1C 5X1

ENER SEA
VESSEL INFORMATION SHEET

Date: ____________________

Name: ____________________________ Phone Number: ____________________

Mailing Address: ____

____

____

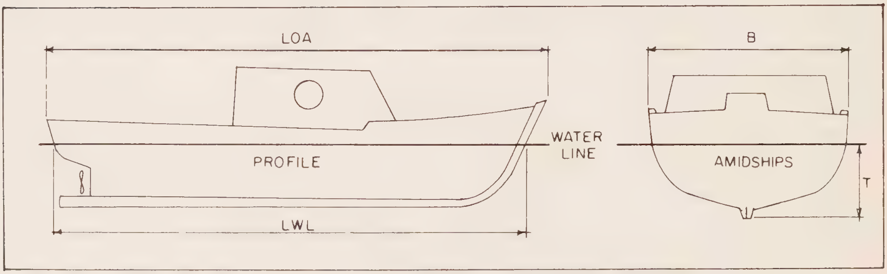
____

Vessel Name: ________________________ CFV #: ________________________

Hull Material (wood, steel, fiberglass): ______________________________

Hull Designed By: ____

Hull Built By: ________________________ Year Built: ____________________

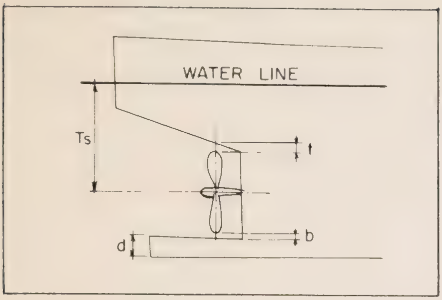


Length Overall (LOA): __________ ft. __________ ins.

Beam Amidships (B) __________ ft. __________ ins.

Length on Waterline (LWL) __________ ft. __________ ins.

Draft Amidships (T) __________ ft. __________ ins.



Draft Aft (Ts) ______ ft. ______ ins.

Clearance Above
Propeller (t) ______ ins.

Clearance Below
Propeller (b) ______ ins.

Depth of Skeg (d) ______ ins.

PROPELLER

Diameter: ______ ins.

Pitch: ______ ins.

Number of Blades: ______________

Supplier: ______________

Nozzle (yes/no): ______________

ENGINE

Make: __________ Model: __________

Maximum Rated
Horsepower: ______________

Maximum RPM: ______________

Gear Box Reduction Ratio: ________

GENERAL

Steaming Speed: __________ knots at __________ RPM

If your vessel uses towed gear (bottom trawls, scallop drags, etc.)

Dragging Speed: __________ knots at __________ RPM

What was your total fuel cost last year: $____________________

COST BENEFIT ANALYSIS:

Estimated Cost of Present Propeller ______________

Estimated Installation Costs ______________

Cost of Fuel Burned Last Year ______________

OPERATING PROFILE:

Do you know other speeds at different R.P.M.?

R.P.M. ______________ Speed ______________

R.P.M. ______________ Speed ______________

R.P.M. ______________ Speed ______________

BOTTOM CLEANING:

Bottom Paint Used (Regular, Antifouling, Sharkskin) ______________

Haulout Cost (Dollars) ______________

Number of Hauls ______________

Cost Per Day Hauled ______________

Total Days to Paint Bottom ______________

Total Cans of Paint Required ______________

Cost Per Can of Paint ______________

Time Before Next Bottom Cleaning ______________

Fuel Cost Per Litre ______________

The next readout, entitled Optimized Steaming Blade (Table 4) demonstrates the capabilities of up to three propellers with different diameters and pitches. By considering the results of the computer comparison, a fisherman can decide the best blade for his particular combination of boat and fishery.

This information is for the same boat as that used in Table 3. These three blades require different RPM's and power torque levels to produce the same amount of thrust (1818 lb.) Blade #1 is second in required RPM's, but requires the least amount of torque and lowest horsepower. It therefore achieves the highest efficiency rating (although only a tiny bit higher than blade #2) and the greatest percentage in fuel consumption reduction. (Each of these blades would be more efficient than the one analyzed in Table 3.)

The best steaming prop for any vessel is one which uses less torque at the same RPM to produce the same amount of thrust, and same speed, as did the original blade. Less torque means less power used and less fuel burned.

However, inshore draggers generally need a prop that performs best at the low speeds required for dragging. In this case, the best prop is one that uses the same amount of torque, or less, to develop **more** thrust. This propeller conserves fuel by letting the vessel cut back on operating RPM while still maintaining the thrust needed for fishing operations.

Table 4. Optimized Steaming Blade

Blade #	DIA	Pitch	Blades	Bar	RPM	Eff %
1	27	16	3	.5	2438	44.19 %
2	28	16	3	.5	2345	44.18 %
3	29	15	3	.5	2364	43.6 %

Thrust lb	Torque lb-ft	Power hp	Cav Coef	Cav Num	% Cav	% Fuel Drop
1818	444	83	.154	.363	4.792%	7.7%
1818	446	84	.133	.338	3.308%	7.28%
1818	452	85	.116	.316	1.383%	6.04%

The fourth readout in the propeller analysis profile is called the Vessel Efficiency Analysis/Cost and Benefits readout. (Table 5). If a fisherman is thinking about changing propellers, this portion of the program shows the percentage of improvement it will make to the fuel efficiency of his vessel. Considering the value of fuel saved, the cost of the new prop plus installation, the estimated prop life, and other factors, this readout tells you how long it will take to recapture your investment.

The computer also shows fuel costs and savings over an eight-year period in graphic form. Figure 2 compares the fuel consumption performance of two other propellers (the present one and a new one) on another vessel.

In many cases, the use of the appropriate propeller on a vessel can offer the operator major savings in fuel costs, and also eliminate damage to props from cavitation. The use of the proper propeller can also reduce vibration, and thus help prolong vessel life while reducing maintenance costs.

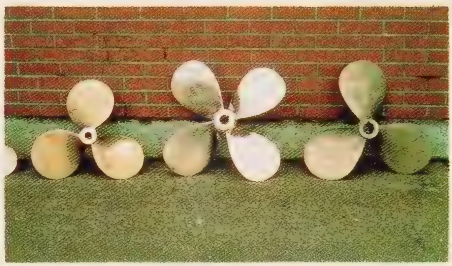
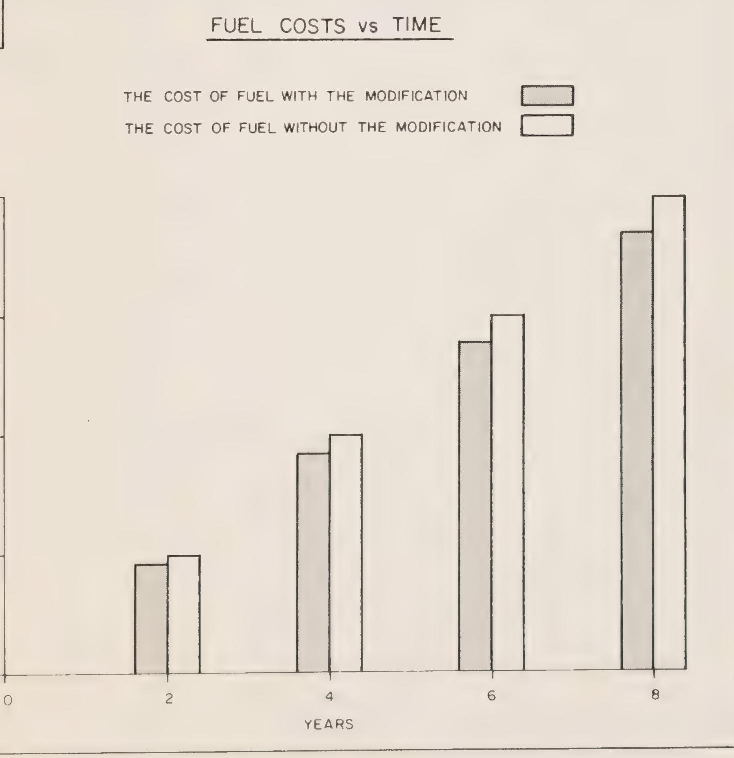


Table 5. Vessel Efficiency Analysis - Costs and Benefits

Improvements:	**Propeller Change**		
Considerations	**1**	**2**	**3**
Efficiency Improvement %	3.684345	3.670128	3.092438
Percent Fuel Saved	7.704567	7.287558	6.041673
Material Costs $	900	850	800
Installation Costs $	100	100	100
Total Costs $	1000	950	900
Estimated Life (yrs)	8	8	8
Fuel $ Burned Last Year	3700	3700	3700
Fuel $ Costs with Modif.	3414.931	3430.36	3476.458
Fuel $ Saved Per Year	285.069	269.6397	223.5419
Total $ Saved Over Life	2280.552	2157.117	1788.335
Payback Period (yrs)	3.507923	3.523221	4.026091
Rate of Return % (IRR)	23.00001	23.00001	18

Fig. 2.



FUEL COSTS vs TIME
THE COST OF FUEL WITH THE MODIFICATION
THE COST OF FUEL WITHOUT THE MODIFICATION
29600
22200
14800
7400
0
FUEL COSTS ($)
0
2
4
6
8
YEARS

Operating profile

The last of the three profiles is the **operating profile**, which gives further information on how the fisherman can save fuel and money. It shows the savings that can be made with two different approaches: 1) installing a new blade that will give the same speed with lower engine RPM's and lower fuel consumption; 2) using either the old blade or a new one, and throttling back to lower RPM's, and therefore slightly lower speed, in order to save fuel.

The information put into the computer is similar to that for the propeller analysis profile: diameter and pitch of the original prop; diameter and pitch of a new, more efficient prop suggested by the computer; gear reduction ratio, and; blade area ratio (BAR). (The BAR is the proportion of the surface area of the propeller's blades to the area of the circle swept by the turning prop.) The final input is the engine's maximum RPM.

In looking at the old and new blades, the computer output will tell the fisherman what engine RPM's each blade will need to maintain certain constant combinations of speed and thrust. Table 6(a) shows the relationships between RPM, speed and thrust for both the old and a newer, more efficient propeller. The analysis shows that the new blade will develop the same thrust as the old one, and give the same speed, with lower engine RPM's. Since lower RPM's means less fuel burned, the recommended new propeller would save the fisherman money. Tables 6(b) and 6(c) show separately the results of lowering RPM's with an old blade and a new, more efficient blade.

Table 6(a): RPM - Speed - Thrust: Old and New Blades

Old RPM (Old Blade)	Speed	Thrust	New RPM (New Blade)
2810	9.00	1824	2737
2660	8.60	1625	2615
2552	8.30	1490	2510
2397	8.00	1292	2365
2197	7.20	1098	2148
2000	6.60	906	1969
1742	5.90	675	1719

Table 6(b): Vessel Efficiency Analysis: Table of Results (Old Blade)

RPM	Speed kts	% Drop Speed	% Drop Fuel
2800	9.02	0	0
2700	8.73	3.22	10.51
2600	8.43	6.47	20.25
2500	8.14	9.71	29.25

Dia 24 pitch 20 blades 3 bar .52 wake fr. .2 gear ratio 2.9

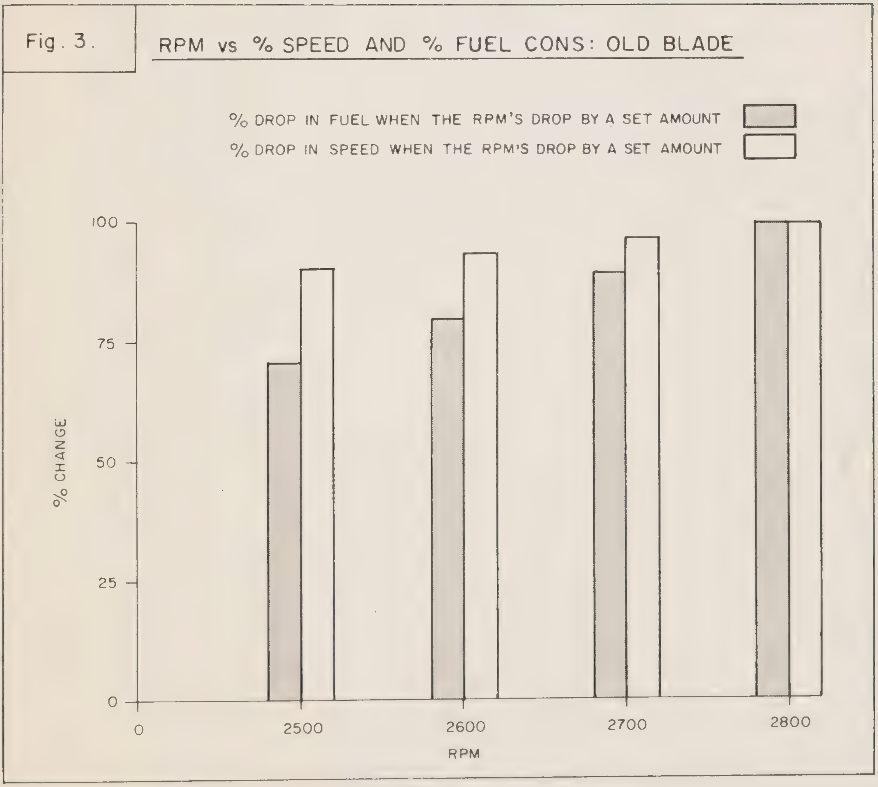
Table 6(c): Vessel Efficiency Analysis: Table of Results (New Blade)

RPM	Speed kts	% Drop speed	% Drop fuel
2800	9.10	0	0
2700	8.89	3.28	10.52
2600	8.59	6.57	20.27
2500	8.28	9.87	29.28

Dia 27 pitch 17 blades 3 bar .52 wake fr. .2 gear ratio 2.9

The computer also generates graphs to illustrate this information. Fig 3 duplicates Table 6(b), showing the percentage of reduction in fuel consumption and speed as RPM's are lowered.

Fig. 3.



The fuel consumption figures obtained under the Operation Profile are expressed as percentages of maximum (100%) rate of fuel consumption. They are predictions, made by the computer, of how fast fuel consumption will drop if RPM's are reduced (or of how much fuel consumption will be reduced if a more efficient blade is installed on a boat).

In order to see how accurate the computer's predictions were, ENER SEA personnel decided to operate a number of vessels and record actual fuel consumption figures at different RPM/speed combinations. (They also wanted to build up a collection of information on a variety of vessels using various types of propellers, so that fishermen with similar boats could obtain information useful to them without having to go through the entire analysis process.)

So far more than 30 vessels have been put through a series of operational trials during which RPM, speed and fuel consumption are accurately recorded. Table 7 shows the results for one of these vessels. The dramatic drop in fuel consumption, especially with the initial reduction in RPM's, is consistent with what the computer predicts. In the case of many vessels the reduction in fuel consumption, and the resulting saving in fuel costs, was even greater than the computer predicted.

What this means is that a fisherman who has a propeller or operational computer analysis done on his boat can trust the results obtained, as long as he takes care to make sure that accurate information about his boat goes into the computer in the first place.

Table 7: Ener Sea Operational Guide
M.V.: Tester 1 Length: 36 ft. Engine: 90 HP Engine **Date: Aug/86**

RPM (engine)	Speed (knots)	Fuel Consumption (gal/hr)	Drop in Speed From Max. (knots)	Drop in Consumption From Max. (gal/hr)	Fuel Saved Per Trip
2800	7.79	4.21	0.00(0%)	0.00(0%)	0%
2600	7.41	2.93	0.38(5%)	1.28(30%)	27%
2400	7.09	2.21	0.70(9%)	2.00(48%)	42%
2200	6.48	1.71	1.31(17%)	2.50(59%)	51%
2000	6.11	1.51	1.68(22%)	2.70(64%)	54%
1800	5.58	1.32	2.21(28%)	2.89(69%)	56%

Cavitation and electrolysis

The ENER SEA program also advises fishermen on two problems which can damage and even destroy propellers. These are cavitation and electrolysis. Either of these problems can catch a boat owner unawares unless close attention is paid to the condition of the propeller. Cavitation is the more common problem of the two, although the damage it causes is often mistaken for electrolysis damage.

Cavitation

Strange as it may seem, cavitation is the result of seawater boiling. Water normally boils at a temperature of 112^{0}F, but that is under the normal sea-level air pressure of 15 lb psi. It will boil at far lower temperatures in conditions of much lower pressure, and that is what happens around a swiftly turning propeller. The water in contact with some parts of the turning blades is under extremely low pressure and actually boils. As the water boils, tiny bubbles form on these parts of the blades, especially towards the tips of the blades. The bubbles move inward toward the center of the blade, where the pressure is higher; as the pressure on them increases they suddenly collapse or burst inward onto the surface of the blade.

The constant impact of millions of bursting air bubbles gradually starts to break tiny particles of metal out of the surface of the propeller blades. These bits of metal are far too small to be seen by the human eye, but over the course of time the surface of the blade becomes rough and pitted, and this can be easily seen. Once the damage gets started it can grow rapidly until the blade is severely damaged and its driving efficiency very much reduced.

There are several signs to look for when checking for cavitation. 1) The first damage occurs as small pits on the back side of the blades; they will occur mainly at the edges and toward the tips of the blades. 2) As the damage increases the pits will grow in number and size and begin to join up, until large rough gouges appear in the surface of the propeller. These will tend to follow the water's path over the surface of the blades in a curved pattern. 3) As the loss of metal from the propeller becomes severe the operator should be alert to excessive noise and/or vibration at operating speeds; this could be caused by the roughness of the blades or by the propeller losing its balance as the metal wears away unevenly in different places.

There are three possible solutions to the problem of cavitation: 1) reduce operating RPM until the speed of the turning propeller is lowered to a point where the water no longer boils; 2) increase propeller area by installing a new propeller with either wider blades, longer blades or more blades; 3) install a propeller with a different shape less prone to cavitation.

The first solution is the simplest and cheapest. It will mean some loss in speed but it will also save fuel along with saving the blade. On many older Newfoundland longliners the propeller opening is too small to allow the installation of a new propeller with larger diameter (longer blades). On these vessels the best new propeller may be one with more blades.

The propeller analysis profile contains a section that can make specific recommendations for changes in vessels experiencing cavitation problems.


Electrolysis

A less common problem, but one that can cause severe and costly damage when it occurs, is corrosion caused by unwanted or 'accidental' electrical currents. Two types of corrosion can occur: galvanic corrosion and electrolytic corrosion.

Galvanic or bi-metallic corrosion occurs when two different metals are placed close to each other in seawater (for example, a bronze propeller mounted on a stainless steel shaft). A weak electrical current occurs between the two metals which eats away the less noble (usually the softer) of the two. (In the case of the bronze propeller on the steel shaft, the propeller will be corroded.)

An additional problem is that when the corroding metal is imbedded in or attached to wet wood, the wood may also decay rapidly into a soft pulp. Parts of the planking or structural members of a boat can suffer quick, severe and very costly damage in this way.

The best means of preventing galvanic corrosion is to make sure that metals situated in water are similar, or as close to each other as possible on the galvanic scale. Where this is not possible or practical a common solution, familiar to most fishermen, is to place a less noble metal in the vicinity of the metal that is danger of being corroded. This less noble metal will attract the corroding electrical current, thus protecting the propeller or other metal part that must be kept whole and strong.

'Sacrificial' zinc anodes are commonly used for this purpose. They are usually clamped to the propeller shaft and stern post to protect the propeller. Care must be taken, however, to use the right quality zinc, to place it in the right spot and to use the right method of attachment. (A zinc held in place with a tin strap, for example, will not work.)

Electrolytic corrosion of underwater metals is less common in wooden vessels than galvanic corrosion, but the damage can be severe when it does occur. The problem results from an accidental leakage of electrical current from inside the vessel into the water. This can be caused by a number of things, including dirty and damp electrical connections, electrical wires run in the bilge, and cross-connection of wires to electrical fittings.

Prevention is the best protection. Take great care in installing, wiring and maintaining all electrical items on a boat. This is especially true if the vessel will be periodically using the heavier dockside electrical power. Use zinc anodes if electrolytic corrosion seems to be occurring. If there is a persistent case of electrolytic corrosion which can't be corrected, the owner should consult a naval architect, shipbuilder or other experts to try and find the cause, and the cure.

ENER SEA's Computer System

Most of the equipment in the ENER SEA van won't look too strange or forbidding to the owner of a modern, well-equipped longliner with its radars, fish finders, communications gear and other wonderful gadgets.

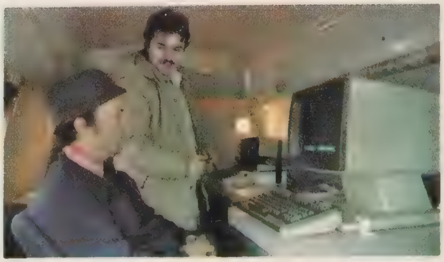
There are four main items.

The first is the computer itself, a Compag Plus. Its information storage system can hold the equivalent of 5120 double-spaced typewritten pages, stored on those little round disks that look like miniature stereo records. That's enough storage capacity to record the name and address of every fisherman in the province six times over.

Then there is a display screen, something like a small TV screen, used to display the information, including tables and graphs, churned out by the computer.

The screen is linked to a printer and plotter, which will print the same information on paper so the fisherman can be given a permanent record of his boat's energy profiles.

There is also a keyboard, much like a modern typewriter, used to put information into the computer. However, the fourth major component of the system is the most unusual one from the average observer's point of view; unusual partly because it can't be seen at all. This is the system's 'software' (as opposed to the 'hardware' described above). The software is a complex package of information about different types of propellers, engines, hull shapes, etc., plus a specially prepared set of instructions. This is all used by the computer to compare information about one boat to similar information about others, and come up with new information about the one boat to make it more energy efficient. The software package was prepared by SEIMAC Ltd., a St. John's firm that specializes in writing marine software for computer programs and has been further developed by the Fisheries Development staff.



Summary

The Technology Development and Transfer Division has developed the ENER SEA program to help Newfoundland's inshore and nearshore fishing fleets become as efficient as modern technology will allow. The program design permits fishermen in the province to use the best of modern computer technology to accurately define their fuel costs, and can recommend changes in propellers and operating habits that should save the fisherman money.

Anyone using the ENER SEA program, however, must realize that the ultimate responsibility for the efficient operation of his own fishing enterprises lies in the fisherman's own hands. While programs like ENER SEA can make valuable recommendations, those contemplating changes of vessels, engines, or propellers as a result of their ENER SEA profiles are urged to consult a qualified naval architect or shipbuilder for a second opinion on the intended changes. If the first two opinions on any proposed changes don't agree, you'll want to keep checking until you find agreement on the best course of action.

The people responsible for developing the ENER SEA program would appreciate your reactions to it, and to this brochure. Any comments should be forwarded to the address given in the front of this brochure.

Notes

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